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(54) **A rifle**

(57) A rifle having a maximum length of 0.91m (3 feet) including a barrel (34) which reciprocates backwards and forwards in a barrel cage (4), the barrel extending over at least 75% of the said maximum length of the rifle, and supporting a breech block at its rear end.

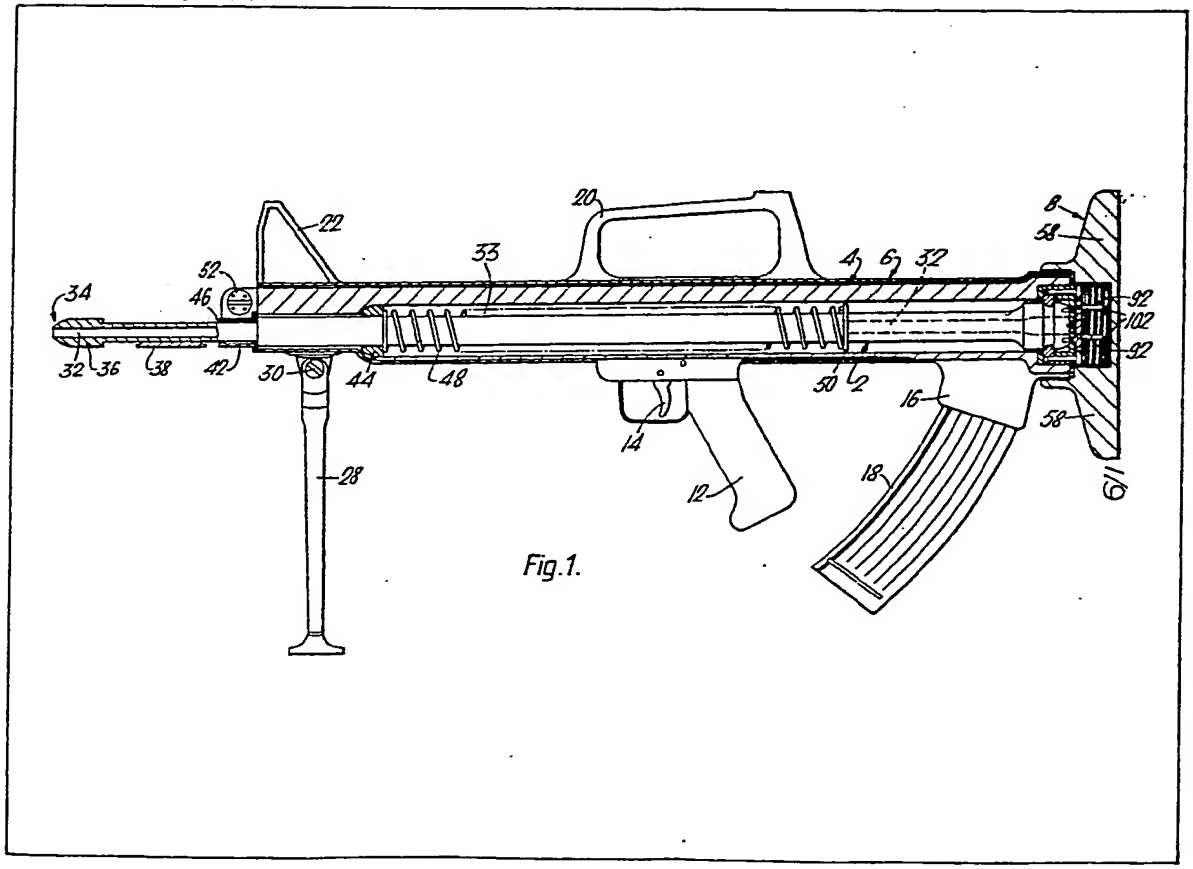

Fig.1.

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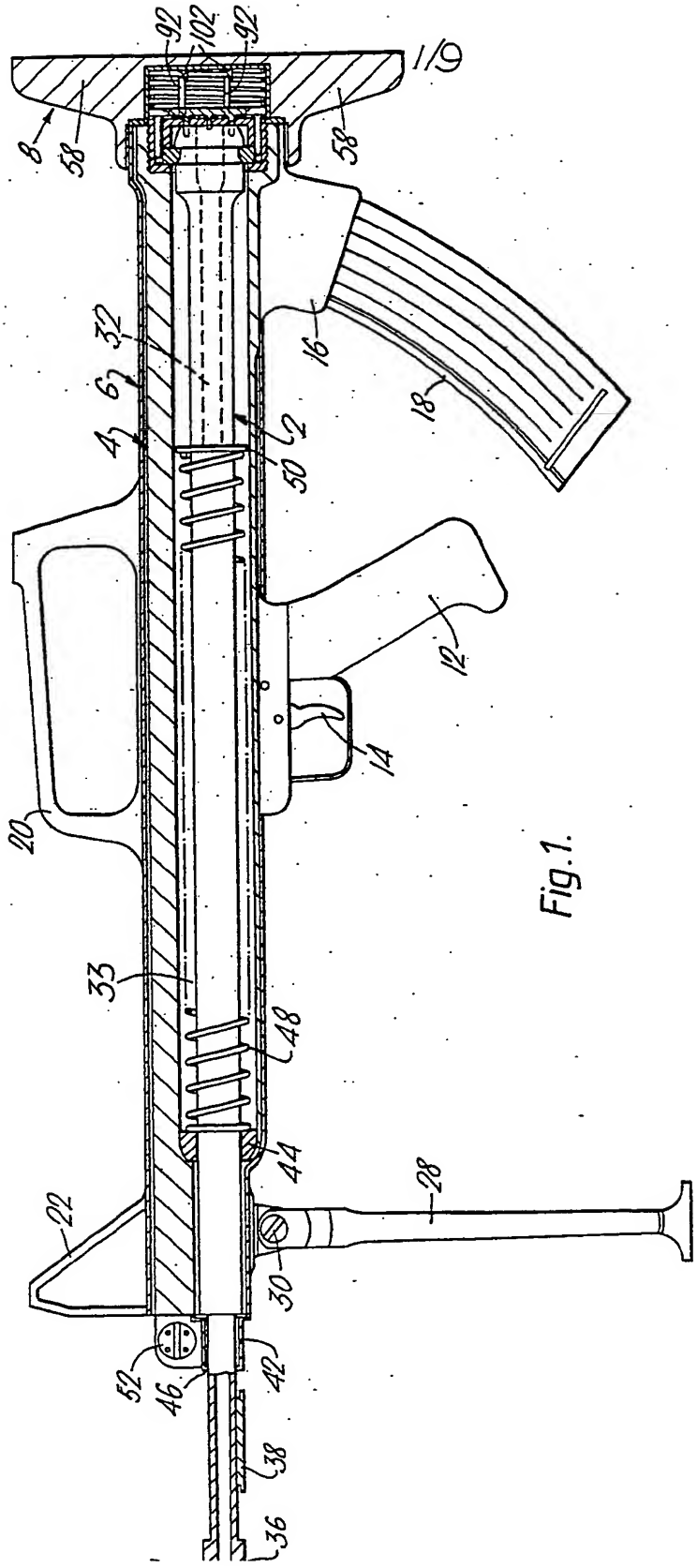
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Fig.1.

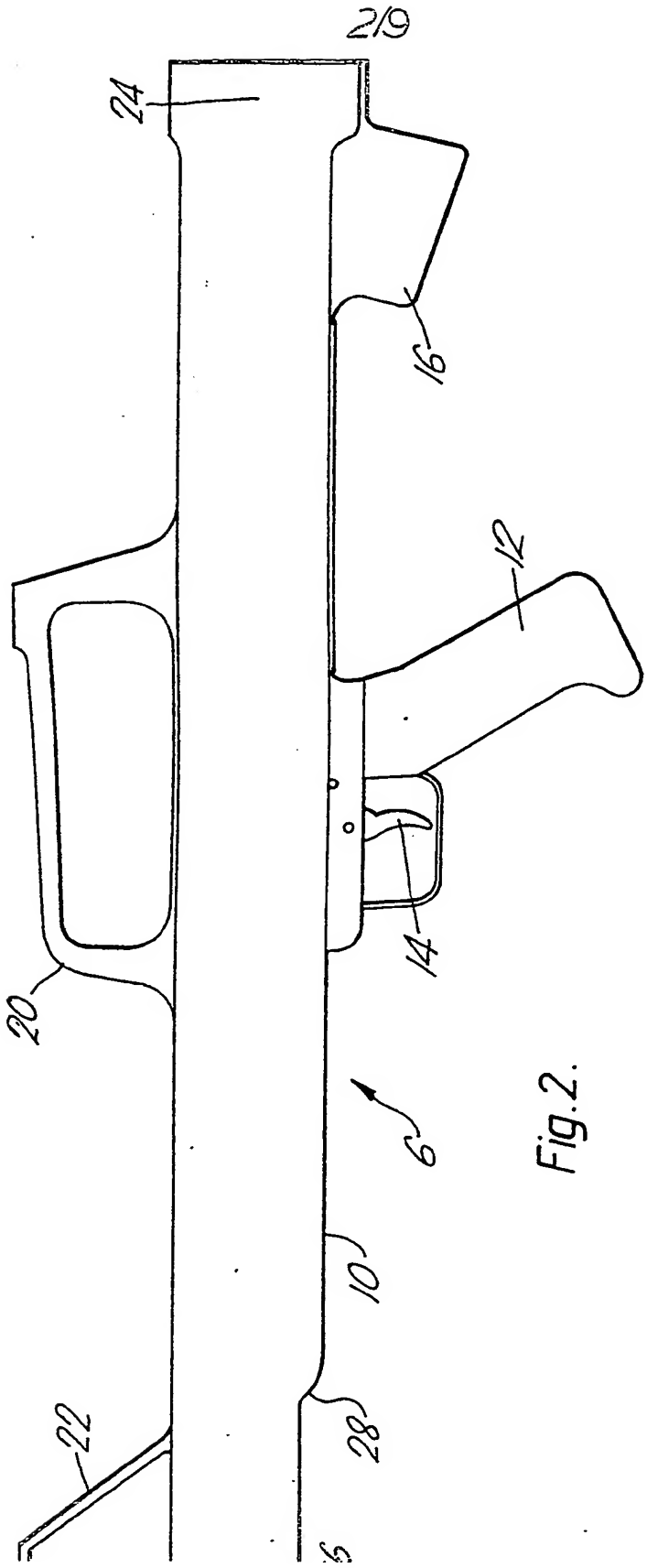

Fig.2.

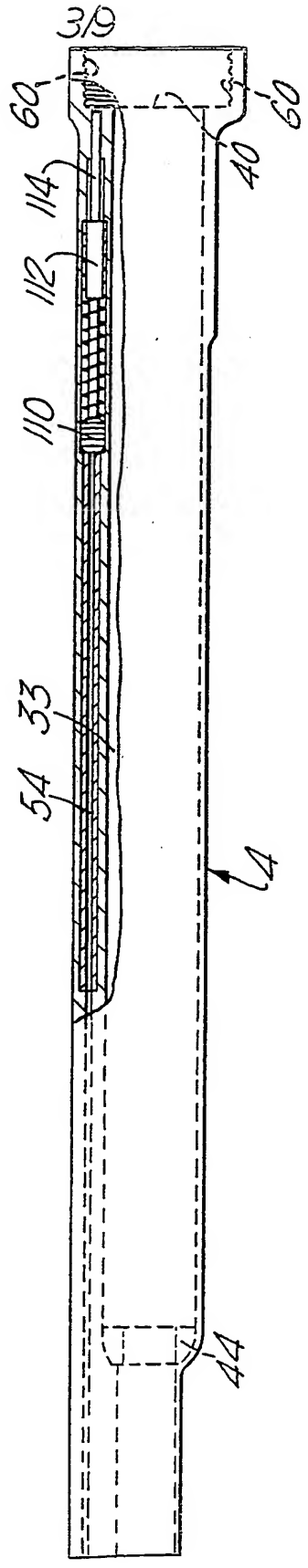

Fig. 3.

Fig.4.

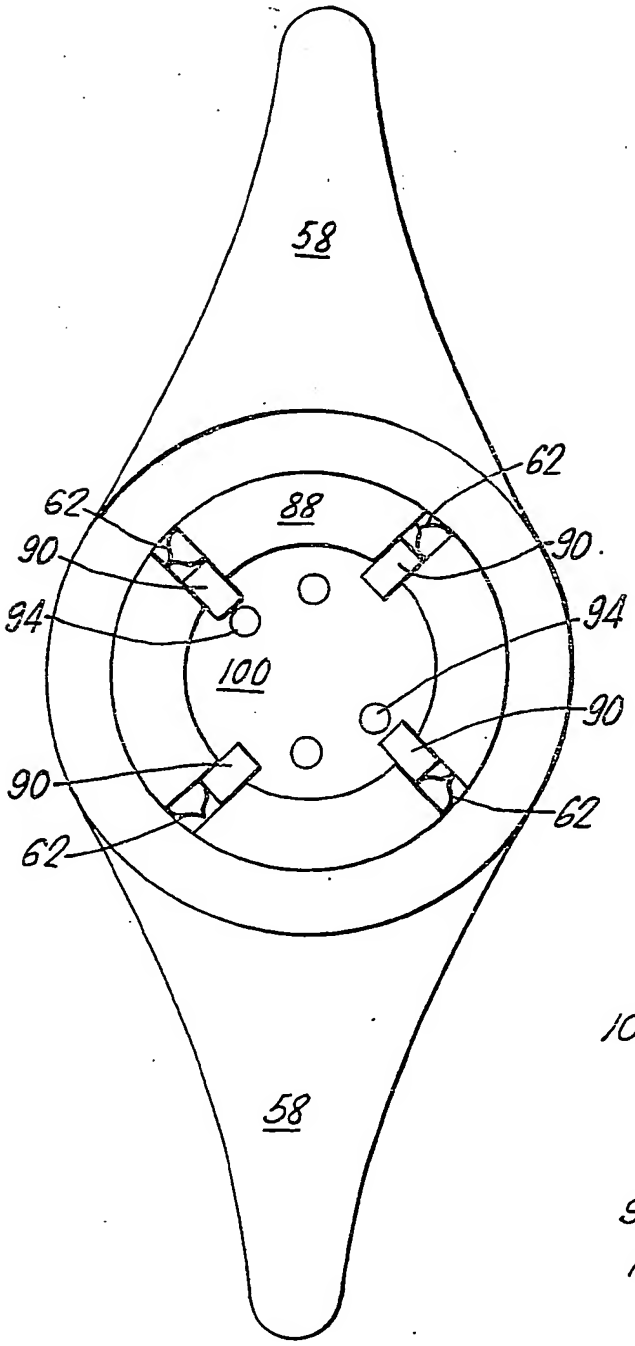

Fig.5.

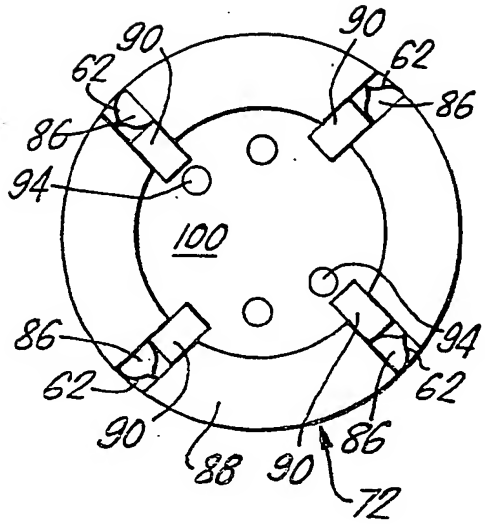

Fig.6.

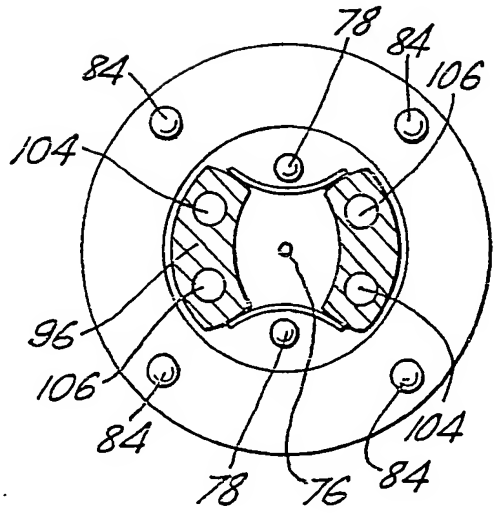

Fig. 7.

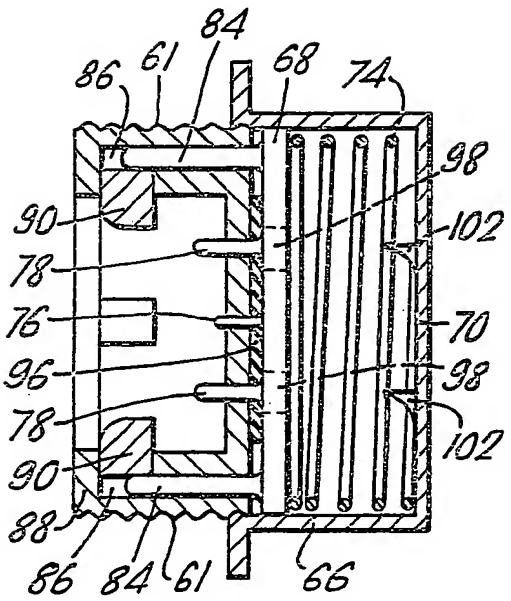
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Fig. 8.

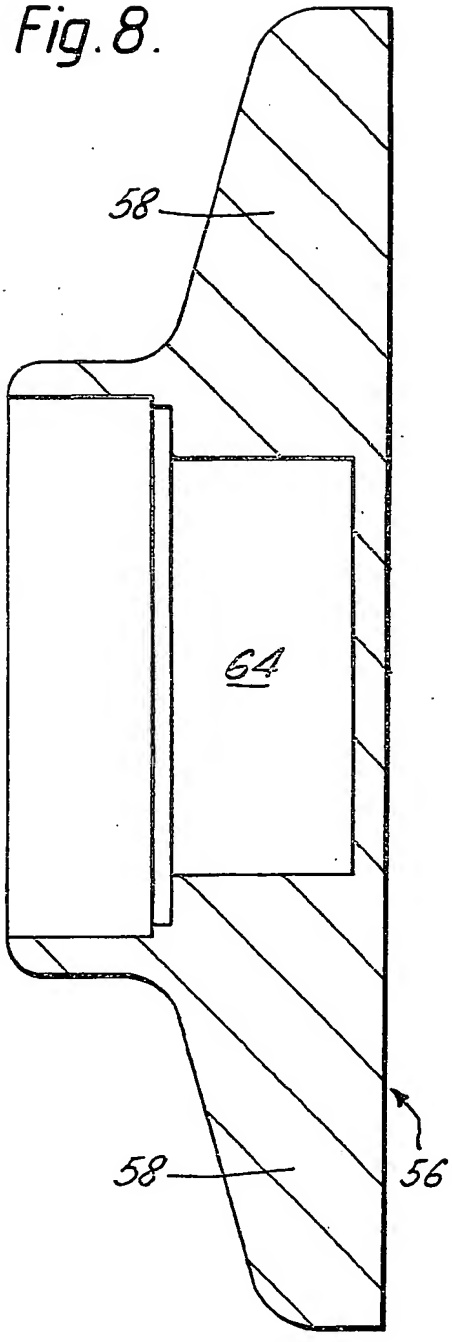
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Fig. 9a.

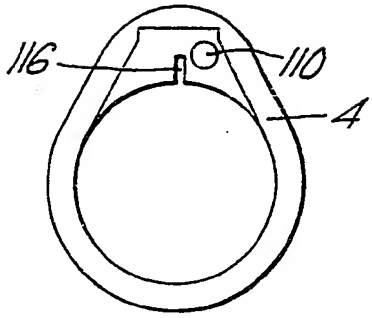


Fig. 9b.

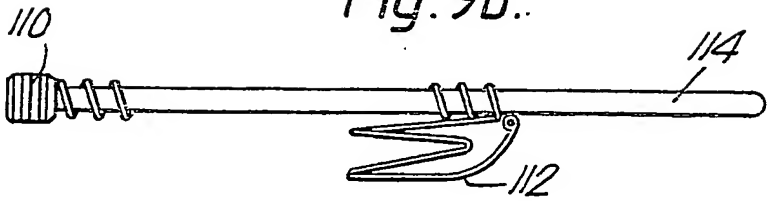
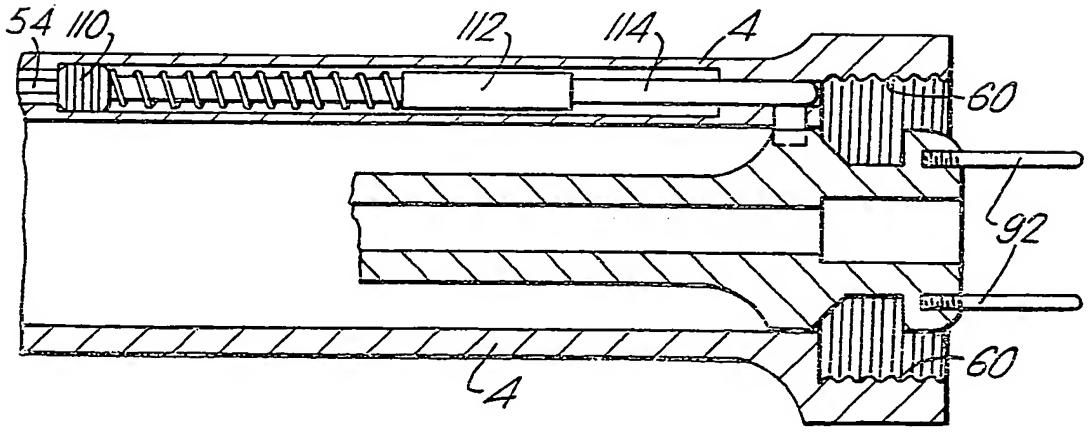


Fig. 9c.



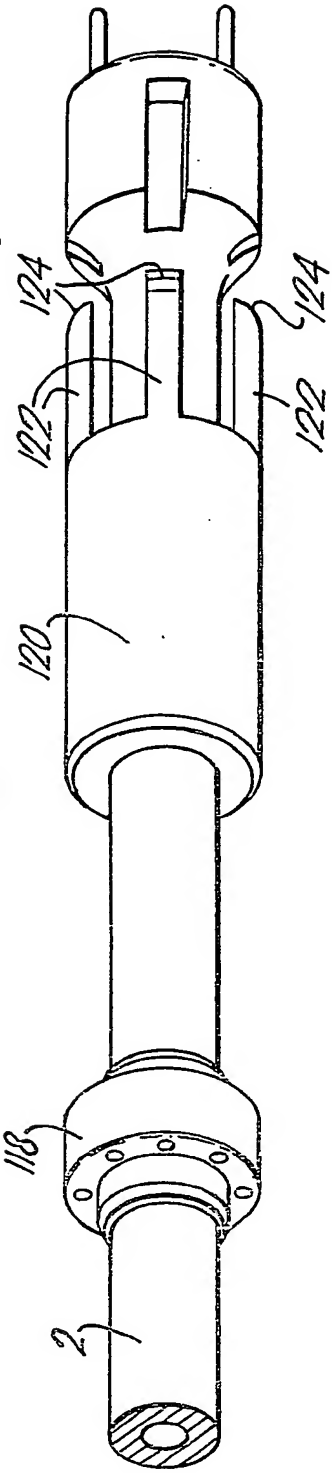


Fig. 10a.

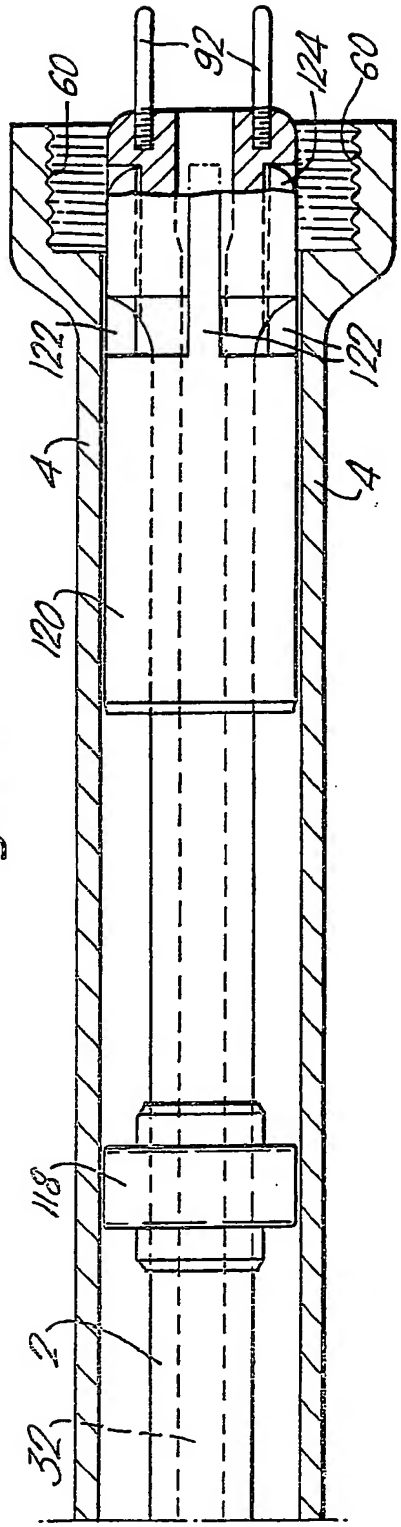


Fig. 10b.

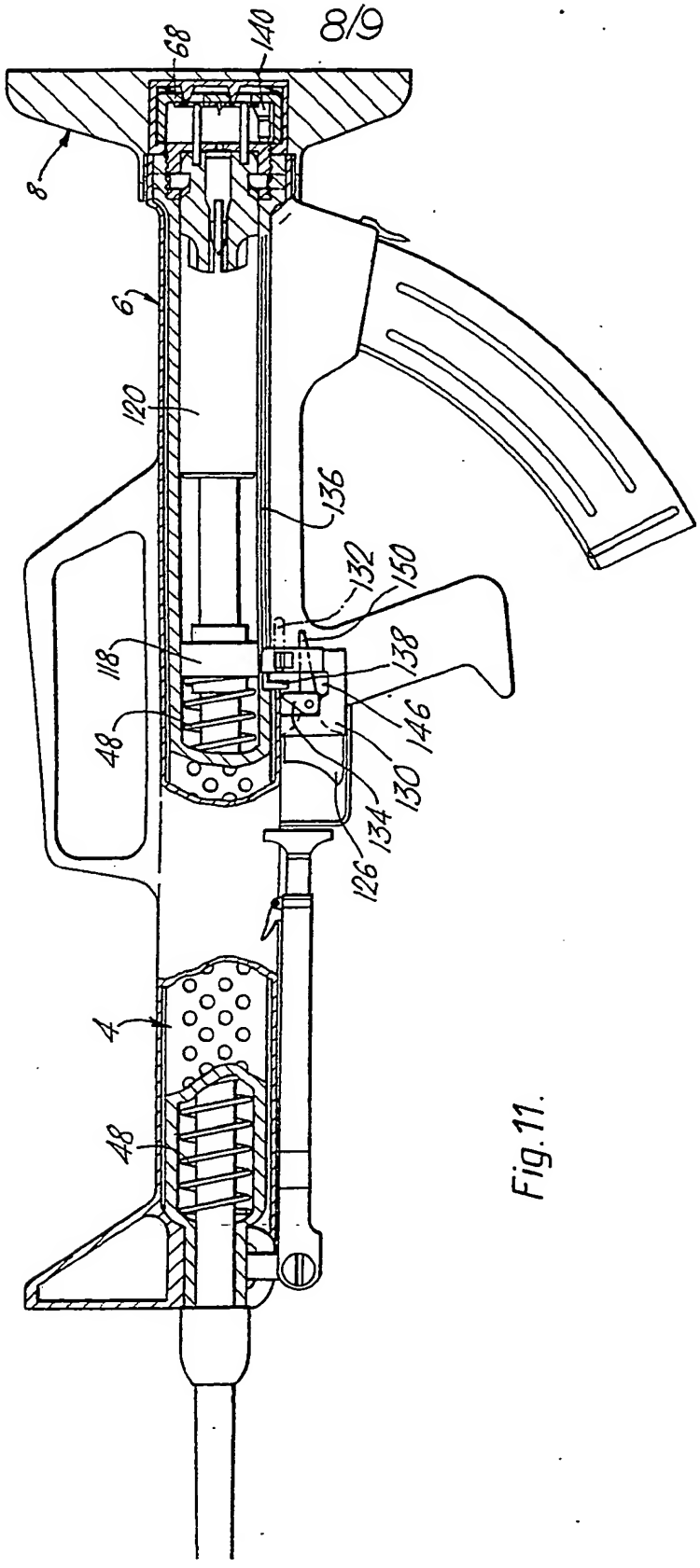


Fig.11.

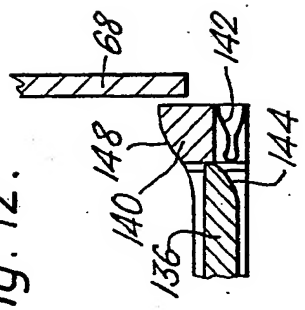

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Fig. 12.

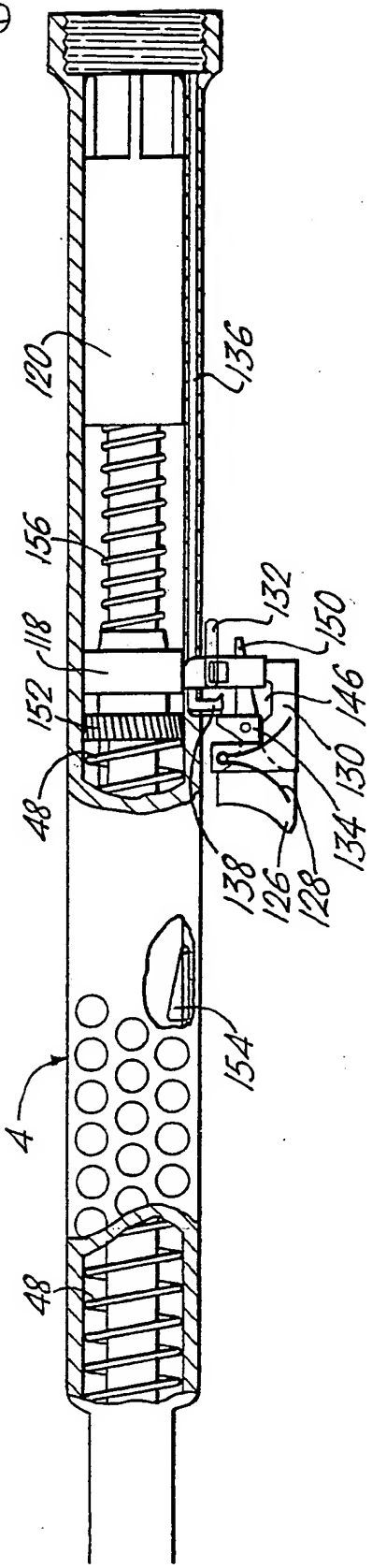
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Fig. 13.

SPECIFICATION

A rifle

The present invention relates to firearms, and in particular to rifles.

In general, if one wishes to produce a rifle which has a long range and is accurate over this long range one has to use a barrel with a relatively long bore. Early rifles such as the Enfield and Springfield rifles had barrels with bores which were about 3ft in length; as a result, they had a long range. However, the rifles were cumbersome because of their length and because they had to be loaded from the muzzle.

The next generation of rifles were bolt-action rifles in which the cartridges were loaded into the rifle by using a bolt at the rear of the barrel. These rifles were still long in overall length but a smaller proportion of the length of the rifle was taken up with the barrel of the rifle since several inches of the barrel was lost in providing the arrangement with the bolt for loading the barrel from the rear.

All these rifles have the disadvantage that they are very long and are therefore relatively cumbersome to use.

In 1944, the German army began to use a much more compact weapon known as the MK 44 Assault Rifle. A revelopment of this rifle is still much in use today in the form of the Russian A.K. 47 Kalashnikov Assault Rifle. It is a compact weapon weighing 9½ lb, with a barrel 16.3 inches long, and which uses a medium powered round. Although its compactness makes this rifle very much easier to handle than its predecessors, the reduced length of its barrel means that it has a very much shorter service range of a maximum of 300 yards. The shortened range results from the fact that a substantial part of the force generated by the explosion of the propellant charge is dispelled as the bullet issues from muzzle of the barrel. In order to make full use of the propellant charge a long bore is necessary to ensure that the bullet remains in a confined space for a time which is long enough for all the charge to burn out and for the maximum driving force to develop.

Because of the A.K. 47's short range, resulting from its short bore, the Russians have had to produce a long barreled version with bipod legs, to be used as a light machine gun. This new R.P.K. still uses the same medium powered cartridge.

The A.K. 47, and the R.P.K. light machine gun version, are still not good enough to do the full job required of small arms, and the Russians have had to produce a new General Purpose Machine Gun, using their old rimmed 7.62 rifle round of 1891.

Other countries are also engaged in a search for a new- light, and compact small arm weapons system and it is clear that there is a need for a light, very short rifle, with a relatively long service range of 500 yards or more and which is capable of operating with an intermediate or equivalent round of ammunition.

According to the present invention there is provided a rifle having no bolt or breech-block and having a maximum length of 3 feet, the rifle including a barrel which reciprocates backwards and forwards to act as its own bolt or breech-block, the barrel having a bore which extends over at least 75% of the said maximum length of the rifle.

By using such an arrangement in which the butt of the rifle forms only a small proportion of the overall length of the rifle, and in which there is no separate bolt, the barrel, and consequently the bore thereof, can be made as long as desired, generally from 20 inches up to the standard full length barrel of 30 inches.

The use of a long barrel in the rifle of the present invention enables one also to incorporate in the rifle a bore which tapers from the breech end of the barrel to its muzzle. Preferably the bore at the breech end of the barrel is 9mm in diameter and tapers to a diameter of 6.5 mm at the muzzle.

The ammunition which it is intended should be used with a rifle having such a tapered bore is a steel-cored plastic bullet. This gives the advantage that the bullet initially presents a relatively large surface area upon which the explosive force of the charge can act and therefore impart a greater speed to the bullet, and that as the bullet issues from the bore only the narrower steel core remains and this encounters relatively small air resistance as it travels through the air. The use of such cartridges in the form of medium powered rounds, with a long, tapered-bore, rifle of the present invention provides a new rifle having improved accuracy over a longer range of up to 600 yards, with intermediate round ammunition.

The unique design of the rifle of the present invention, and particularly an embodiment of the rifle incorporating bipod legs, makes it a truly general purpose weapon that can be used as a sub-machine gun, a rifle, or a light-machine gun.

The present invention will now be described more fully, by way of example only, with reference to the following drawings, in which:–

Figure 1 is a side view, partially in section, of a rifle in accordance with the present invention,

Figure 2 is a side view of the body cover of the rifle of Figure 1,

Figure 3 is a side view of the barrel cage of the rifle of Figure 1,

Figure 4 shows a front view of the butt assembly of the rifle of Figure 1,

Figures 5 and 6 show respective front views of the breech-block and striker disk used in the rifle of Figure 1,

Figures 7 and 8 show respective side views of various parts of the butt assembly of Figure 4,

Figures 9a, 9b and 9c show in detail an arrangement for unlocking the barrel of the rifle of Figure 1,

Figures 10a and 10b show an alternative unlocking arrangement for unlocking the barrel of the rifle of Figure 1,

Figure 11 shows a side view, partly in section, of an alternative embodiment of a rifle in accordance

with the present invention, and

Figure 12 shows a side sectional view on an enlarged scale of part of the rifle of Figure 11, and

Figure 13 shows a partial side view, partly in section, of yet further alternative of a rifle in accordance with the present invention.

In the Figures, like reference numerals refer to like parts.

Referring to the drawings, and more particularly to Figures 1 to 3, there is shown a rifle which includes a barrel 2 about 30 inches long which is carried by a barrel cage 4, the barrel being arranged to move reciprocally backwards and forwards within the barrel cage. The barrel cage 4 and the barrel 2 are held in position within a body cover 6 by means of a butt assembly 8 about 1½ inches long which is removably attached to the rear of the body cover 6. Turning of the butt assembly 8 through a half-turn enables it to be withdrawn from the breech end of the body cover and barrel cage and enables one to dismantle the rifle.

As shown more clearly in Figure 2, the body cover 6 comprises a hollow substantially tubular body 10 the lower part of which carries a pistol grip 12, a trigger 14 and its associated mechanism and a socket 16 for receiving a magazine holder 18 with ammunition of appropriate calibre. Since these parts of the rifle are of conventional design and will be well known to a man skilled in the art, they will not be described in any further detail in this specification. On the upper part of the body cover there is positioned a carrying handle 20 for carrying the rifle and a foresight 22, which again are of conventional design. If desired, the lower part of the body cover 6 may also carry a pair of legs 28 (as shown in Figure 1) upon which the barrel of the rifle may be supported. The legs are pivotable about a pin 30 and are arranged in conventional manner to rotate into a second position in which they lie parallel to the barrel under the body cover when the rifle is not in use.

The barrel 2 of the rifle is a steel tube, having a bore 32 extending throughout its length, usually about 30 inches long. Although a bore of constant diameter can be used, in this embodiment of the rifle the bore tapers, e.g. from a diameter of 9mm at the breech end of the barrel to a diameter of 6.5 mm at the muzzle of the barrel. The muzzle 34 of the barrel can be adapted by means 36, 38 to carry a bayonet (not shown). The barrel 2 is housed within a tubular chamber 33 which extends through the length of the barrel cage 4, the barrel and barrel cage being assembled by inserting the muzzle 34 of the rifle into the breech end 40 of the tubular chamber 33 and passing the barrel along the length of the tubular chamber through an annular bush 44 in the tubular chamber until its muzzle protrudes from an opening 46 in muzzle end 42 of the tubular chamber. As will be seen from Figure 1, the barrel 2 is surrounded by a coil spring 48 which abuts at one end against the bush 44 in the tubular chamber 33 and at its other end against a peripheral flange 50 circumscribing the barrel 2. The return spring 48 is part of the mechanism for causing the barrel to reciprocate backwards and forwards within the tubular chamber of the barrel cage when the rifle is operated. The operation of this mechanism will be described in more detail below.

In addition to the tubular chamber 33, the barrel 2 and the barrel cage 4 carry means for conveying exhaust gases from the forward region of the barrel to the rear end of the barrel, which gases can be used to unlock the barrel when the gas pressure has fallen to a desired value. These means for conveying the exhaust gases include a gas regulator 52 of conventional design located on a forward portion of the barrel. Gases pass from the interior of the barrel pass through the gas regulator and into a passage 54 running back along the barrel cage above the tubular chamber. The way in which the barrel is unlocked will be described in more detail below.

In use, the barrel 2 is inserted into the barrel cage 4 which in turn is placed within the body cover 6 and the whole system is then locked together by placing the butt assembly 8 in position at the breech end 24 of the body cover and giving it a half-turn which engages interlocking means 60, 61 of conventional design located respectively on the barrel cage and the outer face of the side wall 88 of the breech block 72 in the butt assembly 8.

The parts of the butt assembly are shown in more detail in Figures 4 and 5 to 8. As will be seen the butt assembly comprises a butt member 56 having two oppositely extending arm portions 58 which facilitate locking and unlocking of the butt assembly on to the barrel cage. The front of the butt member 56 is made with a stepped cylindrical cut away portion 64 which accommodates a cylindrical housing 66. This housing houses a circular striker disk 68 which is urged from behind by a coil spring 74 away from the base 70 of the housing towards the bottom of a cylindrical breech block 72 which is screwed into the top of the housing 66.

The front of the striker disk 68 carries a number of forwardly extending projections which have various functions. In the centre of the disk is positioned a striker pin 76 which causes the explosive charge in the cartridge to fire when it is hit by the pin. On diametrically opposite sides of the striker pin 76 are positioned two alignment pins 78 which are arranged to pass through holes in the base 82 of the breech-block 72 and to be received by two corresponding passages 80 located in the breech end of the barrel. The purpose of these alignment pins 78 is to prevent the striker pin 76 striking a cartridge in the barrel when the barrel is not in the correct position. Only when the barrel is correctly aligned will the pins 78 enter into the passage 80 and allow striking of the cartridge by the striker pins 76 to take place. Closer to the perimeter of the disk are positioned four safety rods 84 at regularly spaced intervals. These rods are arranged to pass into four separate channels 86 in the annular side wall 88 of the breech-block 72, and can only enter into the said channels to their full extent when the barrel 2 is properly locked in position. Thus only when the four locking studs 90 have properly engaged by action of spring 69 in corresponding stops 92 recessed into the outer surface of the barrel wall near the breech end of the barrel can the rods 84 pass behind the rear of the locking studs 90 and allow the striker pin to hit the explosive

charge in the bullet in the barrel. If the barrel is not in a "locked" condition the studs 90 block the innermost portion of the channels 86, thus preventing the rods 84 and the striker disk from completing its full range of movement towards the breech end of the barrel.

To operate the rifle, the user pulls the trigger 14 and this releases the striker disk which fires the cartridge. On firing the barrel moves forwards and then begins to move backwards towards the butt of the rifle under the action of return spring 48. As will be seen in Figure 1, the breech end of the barrel has two diametrically opposite push rods 92 extending rearwardly. Each of these two push rods 92 passes through an appropriately sized opening 94 in the base 100 of the breech-block 72 and abuts against a plate 96 located on the upper surface of the striker disk. As the barrel moves rearwardly, so the striker disk is also moved rearwardly by the push rods 92 to thereby cock the rifle and cause the coil spring in the housing 66 to become compressed. As the striker disk approaches the base 70 of the housing, two nipples 102 projecting from the said base 70 pass through openings 98 in the striker disk and each engage an orifice 104 on a respective half of the plate 96 on the striker disk. The nipples 102 and the plate 96, are arranged so that as the striker disk is forced rearwardly the nipples 102 force the two sections of the plate 96 to rotate slightly and in so doing cause two openings 106 on the plate 96 to come into alignment with the two push rods 92 which are pushing the striker disk rearwardly. As a result the push rods then pass through the striker disk and this is released and moves in the opposite direction towards the barrel under the action of the spring 74. Provided that the barrel is locked and correctly aligned, the pins 78 and the safety rods 84 can be properly received by the channels in the barrel and the breech-block and the striker pin 76 can hit the cartridge in the end of the barrel.

On firing the barrel is unable to recoil. Exhaust gases pass from the barrel through the gas regulator 52 through passages 54 in the barrel cage to unlock the barrel as will be described below. The barrel is unlocked in time to blow forward and as it does so the push rods 92 on the barrel become disengaged from the striker disk 68 and its associated plate 96, and the coil spring 48 surrounding the barrel becomes compressed. Moreover, as the barrel blows forward the spent cartridge case is removed from the rifle by use of a conventional mechanism (not shown). For example, the side of the barrel can have a projection which strikes a jousting post ejector mounted on the side of the barrel cage as the barrel blows forward. On striking the jousting post thus bats the spent cartridge case out through an ejection opening in the rifle.

Once the spring 48 has been compressed and has absorbed the kinetic energy of the barrel's forward motion, it then causes the barrel to move backwards again; as it does so, the barrel acts as its own bolt and picks up a fresh cartridge which has been pushed upwards into the barrel's path by a spring mechanism housed in the magazine 18. The barrel will continue to move rearwardly until it is locked in position by the studs 90 once again whereupon a further bullet can be fired from the rifle, whereupon the sequence of blowing forward, reloading and firing can begin once again.

Unlocking of the barrel is achieved by use of the arrangement shown in Figures 9a to 9c and Figure 3 which includes a piston 110 carrying a compressible leaf spring 112 housed in a suitable chamber in the top of the barrel cage downstream of gas passages 54. As gas under pressure, emanating from the barrel after a bullet has been fired, passes along passage 54 it meets piston 110 which is caused to move rearwardly. As it does so the compressible leaf spring 112 is squeezed between the rod 114 on the piston and a vertical fin 116 on the top of the barrel. The resilience of the spring is chosen so that when the gas pressure in the rifle has dropped below a given value the spring can then open out and by pushing on the fin 116 of the barrel it will cause the barrel to rotate about its axis. In so doing it brings the locking lug 90 into communication with grooves running rearwardly to the breech end of the barrel along the outside surface of the barrel and thereby allowing the barrel to move forward as a result of the recoil action.

An alternative arrangement for gas assisted unlocking of the barrel is shown in Figures 10 and 10b. In this arrangement, gas is channelled from the barrel through a gas regulator 118 along the outside of the barrel whereupon it forces a cylindrical sleeve 120 mounted around the barrel to move rearwardly towards the breech end of the barrel. As it does so four probes 122 with tapered ends 124 are forced to move along four slots on the outside of the barrel into contact with the four safety studs 90 which are thereby caused to move radially outwardly and release the barrel so that it can move forward.

A rifle incorporating the alternative unlocking arrangement of Figures 10a and 10b is shown in Figure 11. Figure 11 and Figure 12 also show in more detail a preferred trigger mechanism for use with the rifle of the present invention. The trigger mechanism is adapted to be operated either to fire single shots or to automatically fire repeated shots. As will be seen in Figures 11 and 12, and also in Figure 13, the said preferred trigger mechanism incorporates a trigger 126 biassed forwardly of the rifle by a leaf spring 128 which is mounted in a housing 130 which also houses the trigger 126. The selection of the mode of firing of the rifle is performed by moving a selection lever 132 on housing 130 from a horizontal position (as shown in Figure 11) in which only a single shot is fired to a vertical position in which repeated firing takes place.

As mentioned above, for firing a single shot the lever 132 is kept in a horizontal disposition. When the lever 132 is in this position, as the trigger is pulled and moves backwards, it forces backward an actuator 134, an upper portion of which engages the foot 138 of an L-shaped rod 136, and thereby also forces backwards the L-shaped rod 136. The rod 136 is accommodated by a suitable passage in the barrel cage 4 of the rifle, and projects from the breech end of the barrel cage for engaging a catch 140 for

engaging and releasing the striker disk 68. The catch 140 is permanently urged toward the axis of the barrel by a spring 142. Rearward movement of the L-shaped rod 136 on depression of the trigger causes the tapered rear end 144 of the rod to engage a suitable surface of the catch 140 and thereby force the catch 140 radially away from the axis of the barrel against the face of the spring 142. As the catch 140 is depressed by the rod 136, the striker disk 68 is released and is then pushed forward by spring 74 to strike the rear of the cartridge 144 in the barrel.

With lever 132 in a horizontal disposition, as the trigger is pulled, and thereby striker disk 68 is released to fire a shot, the actuator 134 drops into a shallow depression 146 in the bottom of the housing 130, and thus disengages from the foot 138 of the L-shaped rod. As a result, the rod can return to its original position and release the catch 140 which can then move radially inwardly under the action of spring 142. When the barrel begins to travel backwards again under the action of return spring 48, it forces the striker disk 68 backwards, and as it does so the edge of striker disk depresses the catch 140 by passing over the sloping upper surface 148 of the catch. After the striker disk 68 has passed over the catch 140, the catch moves radially inwardly again to engage the edge of the striker disk and prevent it from firing another round until the trigger is depressed once again. Upon release of the trigger, spring 128 causes the trigger and its associated actuator 134 to move forwardly again.

For the automatic firing of a burst of shots, the lever 132 is positioned in a vertical position. In this position, this lever acts in combination with a tapering projection 150, which extends rearwardly from the actuator 134 and is pivotally connected thereto and passes through a suitable port in the rear of the housing 130, to prevent the actuator 134 from dropping into the shallow depression 146 when the trigger is pulled. As a result, all the time that the trigger is kept depressed, the actuator 134 remains in contact with the foot of the L-shaped rod 136, which in turn keeps the catch 140 depressed so as to keep the striker disk 68 free to reciprocate forward and back and automatically fire a number of shots. Not until the trigger is released and moves forward can the L-shaped rod return to its original position thereby releasing catch 140 which then engages the striker disk 68 and prevents it from striking a further cartridge.

In the specific embodiments of the invention described above, the rifle operates with blow forward action with delaying locking to lock the barrel in position before firing, and with gas operated unlocking which takes place in time for the barrel to blow forward.

In an alternative embodiment of the invention the barrel is not locked during firing and unlocked after firing. In this arrangement no locking studs 90 are required, nor is there any need to incorporate gas passages and gas regulators in the rifle. As a result, the rifle can be made lighter and is of simpler construction. In this embodiment the principle of a rigid standing breech is used: with the barrel unable to recoil it blows forward to extract and eject a spent cartridge and prepare for reloading. This type of arrangement is suitable for low powered cartridges.

In a further alternative embodiment, part of which is shown in Figure 13, the rifle of the invention is adapted for full gas operation. In this arrangement, the exhaust gases from the barrel pass out of barrel through a gas regulator 118 and are used both to unlock the barrel after firing and to assist in compressing the return spring 48. In this embodiment an annular member 152 is interposed between the gas regulator 118 and the return spring 48. After firing gases from the barrel pass out under pressure from the gas regulator and act on the annular member to move it forwardly and assist in compressing return spring 48. The annular member travels forward in the barrel cage until it passes over a catch 154 which keeps the spring 48 compressed until the catch 154 is released. Release of the catch 154 is achieved by the subsequent passage over the catch 154 of the gas regulator 118 which forces the catch downwardly so that it no longer engages the annular member and then allows the barrel to begin to move backwards under the action of the return spring 48. In this arrangement, the barrel is also connected to a spring 156 which immediately after firing urges the barrel forward towards the front of the rifle and thereby assists the gas pressure forcing the barrel forward. Only when the gas pressure has been exhausted does the coil spring 84 then force the barrel back towards the breech-block for reloading and refiring.

It will therefore be seen that the present invention provides a rifle of reduced length but which has a relatively long bore, thus providing a small compact fire-arm of great versatility which is capable of being used at all small arms ranges.

CLAIMS

1. A rifle having a maximum length of 0.91m (3 feet) including a barrel which reciprocates backwards and forwards in a barrel cage, the barrel extending over at least 75% of the said maximum length of the rifle.

2. A rifle according to Claim 1, having a barrel with a bore which is from 508 to 762 mm (20 to 30 inches) in length.

3. A rifle according to Claim 2, wherein the bore is 711 mm (28 inches) in length.

4. A rifle according to any one of the preceding claims, wherein the maximum length of the rifle is no more than 50 mm longer than the length of the barrel.

5. A rifle according to any one of the preceding claims, wherein the bore tapers from the breech end of the barrel to the muzzle of the barrel.

6. A rifle according to Claim 5, wherein the bore tapers from a 9mm diameter at the breech end of the barrel to a 6.5mm diameter at the muzzle of the barrel.

7. A rifle according to any one of the preceding claims, including means for locking the barrel during firing.

8. A rifle according to Claim 7, wherein the means for locking the barrel comprises a plurality of lugs which are displaced to engage with co-operating slots at the breech end of the barrel.

9. A rifle according to Claim 7 or 8, including means for unlocking the barrel after firing, said unlocking being triggered by the action of exhaust gases channelled from the barrel of the rifle.

10. A rifle according to Claim 9, wherein the means for unlocking the barrel comprises a gas ring around the outside of the barrel for conveying exhaust propellant gas from the barrel to act on a sleeve around the barrel which is movable rearwardly to unlock the barrel.

11. A rifle according to Claim 9 or 10, wherein the exhaust gas from the barrel of the rifle is also utilized to assist in moving the barrel of the rifle forwardly after firing of the rifle to compress a return spring which will move the barrel of the rifle rearwardly for firing a subsequent round of ammunition.

12. A rifle according to any one of the preceding claims, including means for controlling the firing of the rifle so that the rifle selectively fires single shots or repeated shots.

13. A rifle according to any one of the preceding claims, wherein the barrel of the rifle is held in the barrel cage by a butt assembly which locks on to the breech end of the barrel cage, the arrangement being such that the barrel can be rapidly removed or interchanged.

14. A rifle according to Claim 1 substantially as hereinbefore described with reference to, and as illustrated in any of Figures 1 to 8, 9a to 9c, 10a and 10b of the accompanying drawings.

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